



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/820,692	03/30/2001	Ting Chien	015290-506	5245

7590 12/14/2004

Peter K. Skiff
BURNS, DOANE, SWECKER & MATHIS, L.L.P.
P.O. Box 1404
Alexandria, VA 22313-1404

EXAMINER

CHEN, KIN CHAN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 12/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/820,692

Applicant(s)

CHIEN ET AL.

Examiner

Kin-Chan Chen

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 7-12 and 14-27 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 7-12, and 14-27 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4, 7-12, and 14-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US 6,451,703) in view of Schmitt (US 6,228,438).

In a method of oxide etching, Liu teaches a method of etching a dielectric layer with selectivity to an underlying stop layer. A semiconductor substrate is supported in a plasma etch reactor wherein the etch reactor is capacitively coupled plasma reactor including a showerhead electrode (col.4, lines 40-42). **MERIE (a capacitively coupled plasma reactor) may be used (col. 4, lines 5-7).** The substrate includes a dielectric layer (e.g., oxide layer) over a nitride stop layer. An etchant gas may be supplied to the plasma etch chamber with **the showerhead (col. 4, line 42).** Etching openings may be performed in the dielectric layer by energizing the etchant gas into a plasma state. The etchant gas may comprise a hydrogen-free fluorocarbon gas represented by C_xF_y gas wherein $y/x < 1.5$. **Liu also teaches that the chamber pressure may be varied (Fig. 7; col. 11, lines 36-37) from 25mT to 70 mT, which overlaps the claimed range. See**

Art Unit: 1765

col. 1, lines 38 through col. 2, line 15; col. 4, lines 5-65 and col. 5 lines 4-8. Tables 1 and 4, Figures 2 and 7.

Liu teaches using capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode. The claimed invention differs from Liu by specifying a dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode. Schmitt is relied on only to show the well-known feature such as dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode as claimed (see col. 1, line 15-17; col. 8, lines 1-12). Hence, it would have been obvious to one with ordinary skill in the art to incorporate those features as disclosed by Schmitt in the process of Liu in order to separately control the upper electrode and lower (bottom) electrode.

As to dependent claim 18, in order to complete the etching of the openings, keeping an amount of etchants sufficient to avoid etch stop is expected in the method of Liu.

Dependent claims 3, 19 and 21 differ from Liu by specifying various etching selectivities. However, the skilled artisan recognizes that in plasma etching, changing the flow rates of etchants and the power change the plasma densities and fluxes, and ion energy, and change the etching properties and etching selectivity. Hence, it would have been obvious to one with ordinary skill in the art to vary the flow rates of etchants and process parameters in order to produce desired etch rate selectivity.

The above cited claims differ from Liu by specifying various compositions (e.g., flow rates of etchants (such as claims 8 and 14) processing parameters (such as

Art Unit: 1765

pressure range at 50-100 m Torr, temperature at 20 to 50 C, and RF energy). However, they are recognized result-effective variables, and commonly determined by routine experiment. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, it is the examiner's position that a person having ordinary skill in the art at the time of the claimed invention would have found it obvious to modify Liu by performing routine experiments (by using various compositions and different processing parameters) to obtain optimal result in order to produce the best etched product achievable. See Demmin (US 6,635,185), Tahara (US 5,356,515) and Loewenstein (US 5,741,396) in the record as evidences.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144.05 II.

Response to Arguments

3. Applicant's arguments filed November 1, 2004 have been fully considered but they are not persuasive.

Applicant has argued that Liu uses MERIE which can not be substituted by Schmitt's dual frequency capacitively coupled plasma reactor. It is not persuasive. In fact, MERIE (magnetically enhanced reactive ion etching) can also be using a capacitively coupled plasma reactor as stated in the office action. Magnetical enhancement feature is simply an added feature to the apparatus whenever there is a need for the process. As has been stated in the office action, Schmitt is relied on only to show the well-known features such as dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode as claimed. Hence, it would have been obvious to one with ordinary skill in the art to incorporate the well-known feature such as dual frequency as disclosed by Schmitt in the process of Liu in order to separately control the upper electrode and lower (bottom) electrode.

Applicant has argued that the claimed invention use different ranges of pressure and temperature. It is not persuasive. As stated in the office action, they are recognized result-effective variables, and commonly determined by routine experiment. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. **In the absence of showing criticality or new, unexpected results**, it is the examiner's position that a person having ordinary skill in the art at the time of the claimed invention would have found it obvious to modify Liu by performing routine experiments (by using various compositions and different processing parameters) to obtain optimal result in order to produce the best etched product achievable. See Demmin (US 6,635,185), Tahara (US 5,356,515) and Loewenstein (US 5,741,396) in the record as evidences. Furthermore, applicant argued

Art Unit: 1765

that Liu teaches an upper limit of 40 mT that teaches away from the claimed invention. It is not persuasive. In an example of obtaining high oxide etch rate (such as near 700 nm-min), Liu states that the pressure should no more than 40 mT, it is simply an example under a given particular product requirement (col. 11, lines 36-49). In fact, Liu teaches **that the chamber pressure may be varied (Fig. 7) from 25mT to 70 mT, which overlaps the claimed range.**

CRITICALITY OF PROCESSING PARAMETERS

"Where the principal difference between the claimed process and that taught by the reference is a temperature difference, it is incumbent upon applicant to establish criticality of that difference" *Ex parte Khusid*, 174 USPQ 59. This decision is clearly analogous to pressure differences and other process parameters. If applicant can establish a showing of criticality in the claimed process parameters, the rejection will be withdrawn.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Demmin (US 6,635,185; Col. 7, lines 5-25) discloses that one skilled in the art of plasma etching may vary composition, flow rate, temperature, pressure, power, time, and bias voltage accordingly to etch a desired material satisfactorily. Tahara (US 5,356,515) discloses that etch rate and selectivity as a function of flow rate (Fig. 8, 10). Loewenstein (US 5,741,396) discloses that selectivity

Art Unit: 1765

as function of (composition) ratio of etchants, also teaches to vary pressure, temperature, gas flow, power, frequency, see col.8, lines 3-12 and Figures.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number

Art Unit: 1765

for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

December 10, 2004



Kin-Chan Chen
Primary Examiner
Art Unit 1765